

## **REMARKS**

### ***Amendments to Claims***

1. Claims 5-49 and 54 have been canceled. These claims will be included in separately filed divisional applications.

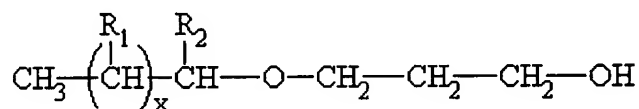
Claim 50 has been amended to depend from claim 1. For reasons discussed herein, Applicants request that claim 50 and claims 51-53, which depend from claim 50, be rejoined in the present application.

Claims 55-78 are new claims added to more particularly describe additional embodiments of the invention. Support for claim 55 can be found at page 9, line 5, of the specification. Support for claim 56 can be found at page 37, line 25. Support for claim 57 and 58 can be found at page 40, lines 12-16. Support for claim 59 can be found at page 42, line 12. Support for claim 60 can be found at page 9, lines 13-14. Support for claim 61 can be found at page 22, line 9. Support for claim 62 can be found at page 10, line 23. Support for claim 63 can be found at page 12, line 25. Support for claim 64 can be found at page 10, lines 23-24. Support for claim 65 can be found at page 10, line 32. Support for claim 66 can be found at page 41, line 10. Support for claim 67 can be found at page 42, line 6. Support for claim 68 can be found at page 45, line 22. Support for claims 69 and 70 can be found at page 12, lines 19-21. Support for claims 71 and 72 can be found at page 15, line 1-2. Support for claim 73 can be found at page 14, line 3. Support for claim 74 can be found at page 14, line 13. Support for claim 75 can be found at page 37, line 3. Support for claim 76 can be found at page 14, line 10. Support for claim 77 can be found at page 13, line 4. Support for claim 78 can be found at page 44, line 18.

### ***35 U.S.C. § 103***

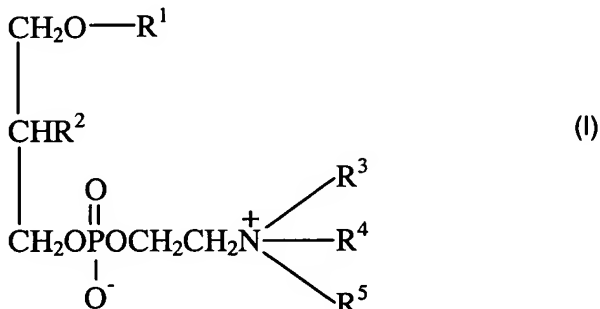
2. The Examiner rejected claims 1-4 under 35 U.S.C. 103(a) as being unpatentable over Hozumi et al. (U.S. Patent No. 4,544,512). In making this rejection the Examiner asserted that "Hozumi et al, teach ether primary alcohol compound, that are analogous to the compounds of the formula depicted in claim 1 ...."

Claims 1-4 of the present application relate to a branched alcohol composition comprising a branched ether primary alcohol represented by the formula:

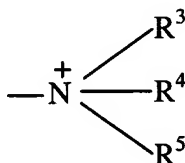


wherein R<sub>1</sub> represents hydrogen or a hydrocarbyl radical having from 1 to 3 carbon atoms, R<sub>2</sub> represents a hydrocarbyl radical having from 1 to 7 carbon atoms, x is a number ranging from 0 to 16, wherein the total number of carbon atoms in the alcohol ranges from 9 to 24.

The focus of Hozumi et al. is upon compounds of the general formula (I):



wherein R<sup>1</sup> is tridecyl or tetradecyl, R<sup>2</sup> is hydrogen or -OCH<sub>3</sub>, and R<sup>3</sup>, R<sup>4</sup> and R<sup>5</sup> independently represent hydrogen or C<sub>1-3</sub> alkyl, or



represents cyclic ammonio, or satisfies some other structural description listed in Hozumi et al. (See Hozumi et al., col. 1, lines 10-50.) According to Hozumi et al., these compounds have value as medicines and antimycotic agents (col. 1, lines 7-13).

In rejecting claims 1-4 over Hozumi et al., the Examiner cited Example 1 in column 13 and Example 5 in column 15 of Hozumi et al. These examples appear to deal generally with the synthesis of 3-tetradecyloxypropanol and 3-tridecyloxypropanol, which are intermediates in the synthesis of compositions having formula (I) of Hozumi et al. Such intermediates are represented generally as compound (VI) in the chemical equation for the synthesis of further intermediates for making compounds of formula (I) of Hozumi et al., shown in column 4, lines 10-20. As the basis for the rejection of claims 1-4, the Examiner asserted:

One of the difference between the claimed compounds and that of the reference herein lie in the selection of substituents of the chain i.e., R<sub>2</sub> is methyl in the instant claimed compounds while Hozumi et al compound is hydrogen (See US '512, column 13, Example 1 and column 15, Example 5). The claimed compounds are so closely related structurally to the compounds of the reference as to be structurally obvious, in the absence of any unobviousness or unexpected properties.

(See Office Action dated May 19, 2003.) In addition, the Examiner asserted that “[i]t is well established that the substitution for hydrogen on a known compound is not patentable modification absent unexpected or unobvious results.” In support of this assertion, the Examiner cited *In re Wood*, 199 U.S.P.Q. 137 (C.C.P.A. 1978) and *In re Lohr*, 137 U.S.P.Q. 548, 549 (C.C.P.A. 1963).

The Examiner further asserted that “[t]he motivation to make claimed compound derives from the expectation that structurally similar compounds are generally expected to have similar properties.” In support of this assertion, the Examiner cited *In re Gyurik*, 596 F.2d 1012, 201 USPQ 552 (CCPA 1979). Thus the Examiner has based the present rejections on assertions of structural similarity between the claimed compositions and the compounds of Hozumi et al.

Applicants agree with the Examiner’s suggestion that Hozumi et al. does not teach, as recited in claim 1, a branched ether primary alcohol wherein “R<sub>2</sub> represents a hydrocarbonyl radical having from 1 to 7 carbon atoms” (for example, R<sub>2</sub> may be methyl as indicated by the Examiner but is not limited to methyl). As recognized by the Examiner, to complete a prima facie case of obviousness, the Examiner must point to a suggestion or motivation in prior art to modify the prior art into the claimed invention. If the Examiner seeks to prove that a suggestion or motivation is to be found in similarity in chemical structure between a prior art composition and the claimed composition, the Examiner must also show that the prior art composition is taught in the prior art to have utilities or properties that one of ordinary skill in the art would expect to also find in the claimed composition. These utilities or properties must be utilities or properties that one of ordinary skill in the art would be motivated to reproduce by modifying the prior art composition.

The three cases (*In re Wood*, *In re Lohr*, and *In re Gyurik*) relied upon by the Examiner to support the Examiner’s prima facie case of obviousness support implementation of this requirement for prior art teachings of utilities or properties when a prima facie case of obviousness is based upon similarity of chemical structures in prior art. In *In re Wood*, 199 U.S.P.Q. 137 (C.C.P.A. 1978), the appellants’ claims were directed to a compound possessing antimicrobial activity. The appellants’ claims had been rejected in the PTO over a prior art reference disclosing a compound, taught in the prior art reference as possessing antimicrobial activity, which differed from the claimed compound only in that the prior art compound was unsubstituted in one position where the claimed compound was di-substituted. *Id.* The Court of Customs and Patent Appeals stated that “[i]n view of the close structural similarity between the claimed compounds and [the prior art compound], and the fact that the latter is disclosed as possessing antimicrobial activity, we believe that one skilled in the art would have been, prima facie, motivated to make the claimed compounds in the expectation that they, too, would possess antimicrobial activity.” *Id.* (emphasis added) (citations omitted). The court affirmed the rejections, but in doing so the court did not rely on structural similarity alone. Properties or utilities were taught in the prior art in this case.

In *In re Lohr*, 137 U.S.P.Q. 548 (C.C.P.A. 1963), the appellants claimed a compound having pesticidal properties. The appellants’ claims had been rejected in the PTO over a prior art reference disclosing a compound, taught in the prior art reference as being useful as a pesticide, which differed from the claimed compound only in that the claimed compound was substituted with methyl groups at two

positions of the molecule where the prior art compound was unsubstituted. *Id.* The Court of Customs and Patent Appeals stated that “[c]onsidering all of the evidence in the record: the close structural similarity, the similar method of making the compounds, the similar properties, the same use, and the inconclusive showing of the affidavit, we are constrained to agree with the Board of Appeals that the claimed compounds and compositions are obvious in view of the prior art.” *Id.* (emphasis added). The court affirmed the rejections, but in doing so the court did not rely on structural similarity alone. Again, properties or utilities were taught in the prior art in this case.

In *In re Gyurik*, 596 F.2d 1012, 201 USPQ 552 (CCPA 1979), the third case cited by the Examiner, the claimed invention was directed to a “thio-” compound having “anthelmintic properties, i.e., broad spectrum activity against parasitic worms of warm-blooded animals.” The prior art specifically named sulfinyl compounds corresponding to the claimed “thio-” compounds and taught that the sulfinyl compounds had anthelmintic properties. *Id.* In addition, the prior art contained a general disclosure that the prior art sulfinyl compounds could be prepared from the corresponding “thio-” compounds. These combined prior art teachings formed the basis of obviousness rejections in the PTO of claims to the “thio-” compound invention. *Id.* On appeal, the Court of Customs and Patent Appeals stated:

A fundamental principle applicable in assessing the obviousness of chemical compounds is that a compound and its properties are, in patent law, inseparable. The present record, however, is devoid of reference by the PTO to the expected properties of the claimed compounds.

An element in determining obviousness of a new chemical compound is the motivation of one having ordinary skill in the art to make it. That motivation is not abstract, but practical, and is always related to the properties or uses one skilled in the art would expect the compound to have, if made. The present obviousness rejection cannot stand without some basis in the expected properties of the claimed compounds.

In obviousness rejections based on close similarity in chemical structure, the necessary motivation to make a claimed compound, and thus the *prima facie* case of obviousness, rises from the expectation that compounds similar in structure will have similar properties. No common-properties presumption rises from the mere occurrence of a claimed compound at an intermediate point in a conventional reaction yielding a specifically named prior art compound. That an intermediate/end-product relationship exists between a claimed compound and a prior art compound does not *alone* create a common-properties presumption. Absent that presumption or other evidence of motivation, it cannot be said that it would have been obvious to stop the process for synthesizing the disclosed end product and isolate the claimed intermediate.

*Id.* (citations and footnotes omitted). Thus in this case the prior art lacked teachings that would lead one of ordinary skill in the art to have expectations concerning the properties of intermediate “thio-” compounds. Such expectations concerning properties of compounds are pertinent to *prima facie* obviousness because it is these expectations that might motivate one of ordinary skill in the art to examine and subsequently construct or redesign those compounds in an effort to reproduce those

corresponding properties. Furthermore, the court eliminated any presumption that an intermediate, merely because of its status as an intermediate, has properties in common with a corresponding end product whose properties are characterized in the prior art. Absent any indication in the prior art of what beneficial properties could be expected by a person of ordinary skill in the art if that person were to alter the prior art compound and thereby produce the claimed compound, that person of ordinary skill would not bother to alter the prior art compound to produce the claimed compound. In In re Gyurik, the court reversed the obviousness rejections of the claims.

The Examiner's burden of identifying teachings of utilities or properties in prior art when relying on teachings of similarity of prior art chemical structures in obviousness rejections is evident in the MPEP. For example, see MPEP 2144.08 II.A.4(d) ("It is the properties and utilities that provide real world motivation for a person of ordinary skill to make species structurally similar to those in the prior art. . . . [C]lose structural similarity alone is not sufficient to create a *prima facie* case of obviousness when the reference compounds lack utility, and thus there is no motivation to make related compounds.") (citations omitted); see also MPEP 2144.09 ("A *prima facie* case of obviousness may be made when chemical compounds have very close structural similarities and similar utilities.") (emphasis added). More importantly, MPEP 2144.09 further elaborates:

**IF PRIOR ART COMPOUNDS HAVE NO UTILITY, OR UTILITY ONLY AS INTERMEDIATES, CLAIMED STRUCTURALLY SIMILAR COMPOUNDS MAY NOT BE *PRIMA FACIE* OBVIOUS OVER THE PRIOR ART**

If the prior art does not teach any specific or significant utility for the disclosed compounds, then the prior art is not sufficient to render structurally similar claims *prima facie* obvious because there is no motivation for one of ordinary skill in the art to make the reference compounds, much less any structurally related compounds. *In re Sterniski*, 444 F.2d 581, 170 USPQ 343 (CCPA 1971).

Where structurally similar "prior art compounds 'cannot be regarded as useful' for the sole use disclosed [by the reference],... a person having ordinary skill in the art would lack the 'necessary impetus' to make the claimed compounds." . . .

MPEP 2144.09 states further:

Similarly, if the prior art merely discloses compounds as intermediates in the production of a final product, one of ordinary skill in the art would not have been motivated to stop the reference synthesis and investigate the intermediate compounds with an expectation of arriving at claimed compounds which have different uses. *In re Lalu*, 747 F.2d 703, 223 USPQ 1257 (Fed. Cir. 1984).

(emphasis added). In *In re Lalu*, 747 F.2d 703, 223 USPQ 1257 (Fed. Cir. 1984), cited in the above quote, the court stated that:

In determining whether a case of prima facie obviousness exists, it is necessary to ascertain whether the prior art teachings would appear to be sufficient to one of ordinary skill in the art to suggest making the claimed substitution or other modification. The prior art must provide one of ordinary skill in the art the motivation to make the proposed molecular modifications needed to arrive at the claimed compounds.

*Id.* (citations omitted). The court further recited the reasoning of another court in another case:

How can there be obviousness of structure, or particularly of the subject matter as a whole, when no apparent purpose or result is to be achieved, no reason or motivation to be satisfied, upon modifying the reference compounds' structure? Where the prior art reference neither discloses nor suggests a utility for certain described compounds, why should it be said that a reference makes obvious to one of ordinary skill in the art an isomer, homolog or analog of related structure, when that mythical, but intensely practical, person knows of no "practical" reason to make the reference compounds, much less any structurally related compounds?

Repeating the recognition of the *In re Gyurik* court that "there is no common-properties presumption or evidence of motivation to make the intermediate from the mere fact that an intermediate is in the chain of production of another compound," the court in *In re Lalu* elaborated:

That there is no common-properties presumption accorded to an intermediate and the end product of the reaction involving that intermediate necessarily means that there is no presumption that an intermediate's utility would be the same as that of the end product. Even if an unspecified "usefulness" or utility were all [prior case law] requires, such utility could not be imputed from the fact that the [prior art] final product is "useful".

*Id.* The court in *In re Lalu* also provided that "[t]he mere ability of a compound to act as an intermediate toward the production of other compounds does not alone constitute the sort of 'property' that the cases on obviousness of chemical compounds contemplated."

Again, to complete a prima facie case of obviousness, the Examiner must point to a suggestion or motivation in prior art to modify the prior art into the claimed invention. If the Examiner seeks to prove that a suggestion or motivation is to be found in similarity in chemical structure between a prior art composition and the claimed composition, the Examiner must also show that the prior art composition is taught in the prior art to have utilities or properties that one of ordinary skill in the art would expect to also find in the claimed composition. The Examiner has not met this burden.

The Examiner based the obviousness rejections of the present claims upon an assertion of structural similarity between compounds of Hozumi et al. and compositions of the present claims. The Examiner asserted no other basis for a prima facie case of obviousness. If it is assumed arguendo that such structural similarity may be shown, the Examiner still has not shown in Hozumi et al. that properties or utilities of the hypothetically similar compounds of Hozumi et al. are taught and that one of ordinary skill in the art would have been motivated to pursue similar properties or utilities by modifying the compounds

of Hozumi et al. into a presently claimed composition. The Examiner has alleged structural similarity alone as the basis for obviousness, and structural similarity, if present, is not enough alone to support a prima facie case.

Applicants respectfully submit that Hozumi et al. provides no disclosure whatsoever concerning the properties or utility of the compounds referenced by the Examiner in Examples 1 and 5 in columns 13 and 15 of Hozumi et al. In addition, Hozumi et al. provides no disclosure of the properties of compound (VI) in lines 10-20 of column 4 of Hozumi et al.

All of these compounds referenced by the Examiner are disclosed in Hozumi et al. only as intermediates to be used in the production of a final desired pharmaceutical end product which is the focus of Hozumi et al. Therefore, a person of ordinary skill in the art would not, based on Hozumi et al., be motivated to make any of the compounds referenced by the Examiner in Hozumi et al., except as intermediates in the process of making the desired pharmaceutical end product disclosed in Hozumi et al. One of ordinary skill in the art would not, based on Hozumi et al., be motivated to stop the process of making the pharmaceutical end products of Hozumi et al. to study the properties of these intermediates, and more importantly one of ordinary skill in the art would not, absent any teaching regarding beneficial properties of these intermediates, be motivated to modify these intermediates into the claimed compositions.

Again, the mere ability of a compound to act as an intermediate in the production of an end product cannot by itself constitute the “property” required to support an obviousness rejection based upon structural similarity. The “properties” of an intermediate may not be presumed from the properties of the end product. In summary, there are no properties taught in Hozumi et al. that could possibly motivate one of ordinary skill in the art to modify these intermediates of Hozumi et al.

Without any revelation in Hozumi et al. that the referenced compounds in Hozumi et al. have any desirable properties, alleged structural similarity in Hozumi et al. alone provides no suggestion to one of ordinary skill in the art to modify the compounds of Hozumi et al. into the claimed compositions. As the Examiner has not pointed to any other suggestion or motivation in Hozumi et al. to modify the compounds of Hozumi et al. into the claimed compositions, the Examiner has not met the requirements for a prima facie case of obviousness.

3. In addition to the above, Applicants also respectfully submit that in the branched ether primary alcohols of claims 1-4, the limitation “R<sub>2</sub> represents a hydrocarbyl radical having from 1 to 7 carbon atoms” will provide significant advantages over “linear” molecules such as referenced by the Examiner in Hozumi et al. For example, Applicants believe that as a result of this R<sub>2</sub> limitation in claims 1-4, the solubilities exhibited at low temperatures by both anionic and nonionic surfactant derivatives of the claimed compositions will be better than the solubilities at low temperatures that would be expected of comparable derivatives of the “linear” molecules of Hozumi et al. Also, the resistance to precipitation exhibited by the sulfated derivatives of the claimed compositions in the presence of calcium salts (i.e.,

hard water tolerance) should be better than the resistance to precipitation expected in the sulfated derivatives of "linear" molecules such as in Hozumi et al.

As evidence of the effects of the presence of a group such as  $R_2$  in the claimed compositions, Applicants compare the Krafft temperature of a sulfate of 2-hydroxy tridecanol with the Krafft temperature of a sulfate of 1-hydroxy tridecanol. Applicants also compare the Krafft temperature of a sulfate of 2-hydroxy pentadecanol with the Krafft temperature of a sulfate of 1-hydroxy pentadecanol.

The Krafft temperature refers to the temperature at which the solubility of an anionic surfactant undergoes a sharp, discontinuous increase with increasing temperature (see application text, page 2-3). The Krafft temperature is a useful indicator of detergency performance because at and above the Krafft temperature, surfactants begin to form micelles instead of precipitates, and below the Krafft temperature point, surfactants are insoluble and form precipitates (see application text, page 3). A surfactant should desirably possess a low Krafft point, especially in light of current performance requirements in cold water washing temperatures (see application text, page 4).

2-hydroxy tridecanol and 1-hydroxy tridecanol may be said to differ in that 2-hydroxy tridecanol has a methyl group at the carbon adjacent to the hydroxyl group while 1-hydroxy tridecanol has no such methyl group (the hydroxyl group is at a terminal carbon atom). The Krafft temperature of a 1% solution of the sulfate of 2-hydroxy tridecanol is 21°C, and the Krafft temperature of a 1% solution of the sulfate of 1-hydroxy tridecanol is 27 °C. See Table 15, page 168, volume 7 of *Anionic Surfactants, Part I* (Marcel Dekker, Inc., ed. Warner M. Linfield, 1976), a photocopy of which is enclosed herewith. Thus the Krafft temperature of the sulfate of 2-hydroxy tridecanol is 6 °C lower than the Krafft temperature of the sulfate of 1-hydroxy tridecanol. Applicants believe this difference to be due to the presence of the methyl group at the carbon adjacent to the hydroxyl group in 2-hydroxy tridecanol.

Similarly, 2-hydroxy pentadecanol and 1-hydroxy pentadecanol may be said to differ in that 2-hydroxy pentadecanol has a methyl group at the carbon adjacent to the hydroxyl group while 1-hydroxy pentadecanol has no such methyl group (the hydroxyl group is at a terminal carbon atom). The Krafft temperature of a 1% solution of the sulfate of 2-hydroxy pentadecanol is 34°C, and the Krafft temperature of a 1% solution of the sulfate of 1-hydroxy pentadecanol is 40 °C. See Table 15, page 168, volume 7 of *Anionic Surfactants, Part I* (Marcel Dekker, Inc., ed. Warner M. Linfield, 1976) (photocopy enclosed herewith). Thus the Krafft temperature of the sulfate of 2-hydroxy pentadecanol is 6 °C lower than the Krafft temperature of the sulfate of 1-hydroxy pentadecanol. Again, Applicants believe this difference to be due to the presence of the methyl group at the carbon adjacent to the hydroxyl group in 2-hydroxy pentadecanol.

Applicants believe that the Krafft temperature trends observed between the sulfates of the above-mentioned 2-hydroxy alkanols would also be observed in a comparison of the Krafft temperature of a derivative of the claimed compositions with the Krafft temperature of a comparable derivative of a linear molecule of Hozumi et al. Thus Applicants submit that the Krafft temperatures exhibited by derivatives of the claimed compositions wherein " $R_2$  represents a hydrocarbonyl radical having from 1 to 7 carbon atoms"



(analogous to 2-hydroxy tridecanol or 2-hydroxy pentadecanol having a methyl group at the carbon atom adjacent to the hydroxyl group) should be lower than the Krafft temperatures expected for comparable derivatives of the "linear" molecules of Hozumi et al. (analogous to 1-hydroxy tridecanol or 1-hydroxy pentadecanol having the hydroxyl group at a terminal carbon atom). Applicants believe that such analogy is appropriate, despite the presence in the claimed compositions of the "1,3-propanediol" moiety, which provides a primary hydroxyl group that can react much more readily into derivatives than the secondary hydroxyl groups of the 2-hydroxy-alkanols mentioned above.

In addition, Applicants believe that the differences in the Krafft temperatures associated with the claimed compositions and the Krafft temperatures associated with the molecules of Hozumi et al. will increase with increasing number of carbon atoms in hydrocarbyl radical  $R_2$ . This means that the low temperature solubilities associated with the claimed compositions should be increasingly improved over the low temperature solubilities associated with compounds referenced in Hozumi et al. with increasing numbers of carbon atoms in hydrocarbyl radical  $R_2$  in the claimed compositions.

A further advantage of the claimed compositions resulting from the limitation " $R_2$  represents a hydrocarbyl radical having from 1 to 7 carbon atoms" is that the claimed compositions and derivatives thereof should tend toward lower crystallinity than "linear" compounds, such as referenced in Hozumi et al., and their derivatives. Linear molecules tend to crystallize more readily than molecules that are not linear. A tendency toward lower crystallinity should in turn translate into a lower melting point. The advantages of a lower melting point are evident in the following paragraph from the application text (page 5):

It would also be desirable to manufacture a surfactant which can be easily and economically stored and transported. Polyoxyethylene nonionic linear alcohol surfactants, especially those containing from 3 or more ethylene oxide units, are solid or waxy products at ambient conditions (25°C and 1 atm). Since these waxy or solid products cannot be pumped at ambient conditions, they must first be melted into the liquid phase and kept as a liquid during offloading and feeding into a reaction vessel or a blend tank. Further, the waxy and solid polyoxyethylene linear alcohols must be shipped and/or transported in drums, which take up more warehouse space than liquid storage tanks. It would be desirable to produce a polyoxyalkylene surfactant which is flowable and pumpable at ambient conditions, and yet more desirable to produce such an surfactant which is flowable and pumpable in cold climates where temperatures drop to 0°C.

Applicants believe that the comparable compositions of the present claims and derivatives thereof will have lower melting points than the "linear" molecules of Hozumi et al. and comparable derivatives thereof.

In summary, Applicants respectfully submit that the limitation " $R_2$  represents a hydrocarbyl radical having from 1 to 7 carbon atoms" in the present claims is not a mere obvious structural modification.

4. Applicants respectfully request reconsideration and withdrawal of the rejections of claims 1-4 under 35 U.S.C. 103(a) over Hozumi et al.

New claims 55-59 depend from claim 1. Therefore, for reasons analogous to the statements above, Applicants respectfully request that these claims also be passed to allowance.

### ***Rejoinder***

5. In the restriction requirement dated March 5, 2003, the Examiner required the election of one of several groups of claims which the Examiner had labeled as groups I through VI. Applicants elected group I (Claims 1-4), claims relating to a branched alcohol composition. Claims 50-53 constitute group V, a non-elected group relating to a process to produce a branched alcohol composition.

Claim 50 has been amended to depend from claim 1, while claims 51-53 depend from claim 50. Therefore, claims 50-53 now incorporate all limitations of claim 1. Because the rejection of claim 1 has been traversed and because claim 1 is now allowable, the conditions for rejoinder in accordance with MPEP 821.04 have been satisfied for claims 50-53.

Applicants respectfully request that claims 50-53 be rejoined and passed to allowance. New claims 60-68 depend from claim 50, and therefore Applicants respectfully request that these claims also be passed to allowance.

### ***Fees***

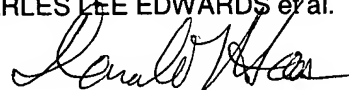
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Each of the rejections having been traversed, allowance of the claims of the present application is respectfully requested. If the Examiner would like to discuss this case with Applicants' attorney, the Examiner is invited to contact Donald F. Haas at the phone number below.

Respectfully submitted,

CHARLES LEE EDWARDS et al.

By:



Their Attorney, Donald F. Haas

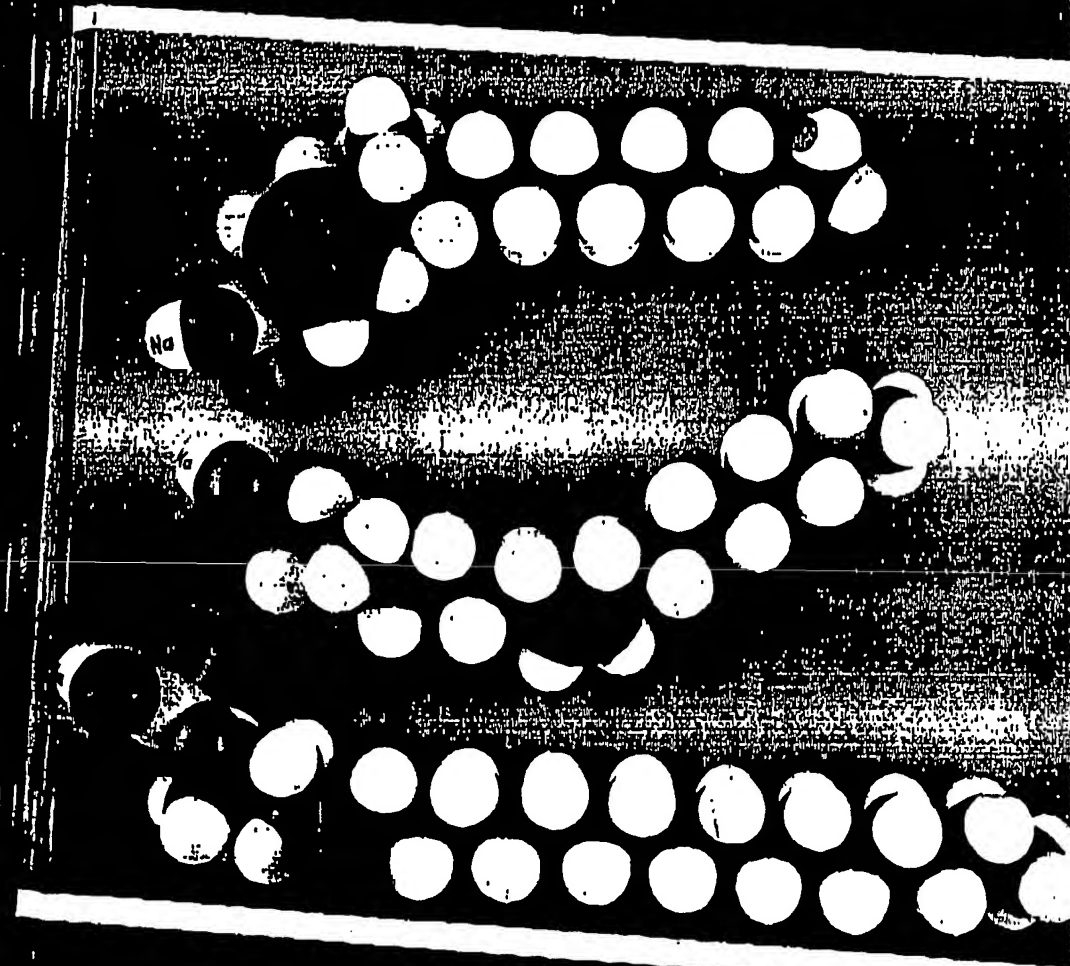
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## PART I

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temperature at which a 1% turbidity on gradual heating, showed solubility of the ether sulfate over an extent than a single oxyethylene

yl group was more hydrophobic and lowered the OMC to a greater extent. The ether sulfate group had less effect, present occurred with oxyethylation [123].

from the alkyl bromide, sodium sulfated to give eight individual compounds,  $(C_8H_{17})_nCSO_3Na$ , where  $n = C_{10}H_{21}$  were pure compounds rather than mixtures. They clearly illustrate the relation between the number of oxyethylene groups shown in Tables 9 and 10. The compounds had sharp melting points but with some decomposition. The compounds for the hexadecyl series were 193, 187, 191, ammonium salts of the 12, 14, 1-122.5, 106-107, 82.4-83.0, compounds with four oxyethylene groups in organic solvents [129].

in sodium dodecyl sulfate which would show a concentration curve was difficult to hydrolysis and gave a curve by a technique using a colorimetric method. Aqueous solutions of sodium within 24 hr and it became

soluble in water than the other series were thus needed before setting properties. Oxyalkylated, increased their water solubility. Sulfated alcohols obtained are known to be excellent detergents due to their low solubility in water. These alcohols before sulfation were insoluble and co-workers [121]. The improved solubility of the parent sodium hexadecyl and dodecyl sulfate (oxyethylene,

10 moles) had greater solubility than the two-mole ethoxamer, but was a less effective detergent as shown in Tables 11 and 12.

Ether sulfates were also more soluble in organic solvents than the corresponding alcohol sulfates and then ten-mole ethylene oxide adduct had a greater solubility in organic solvents than the two-mole adducts [121].

In contrast to the tallow alcohol ether sulfates, the two- and three-mole oxyethylene adducts of lauryl alcohol after sulfation gave sodium, potassium, ammonium, calcium, magnesium, and triethanolamine salts that were capable of forming clear, free-flowing solutions at 30% concentration at room temperature [122]. Because of their more hydrophilic nature these materials could also tolerate a high concentration of electrolyte before their solutions separate. Up to 8.5% of sodium chloride could be dissolved in a 20% active solution of sodium lauryl ether sulfate [124] and the solution remained clear and free-flowing.

Among the tallow derivatives, solubility was increased by the presence of sodium lauryl sulfate [126] or sodium 9,10-dichlorooctadecyl sulfate [127, 130] as well as by the addition of oxyethyl groups. Improved solubility in built solutions and in hard water made them useful in detergent formulations [128]. Another way in which solubility and related properties of the tallow alcohol sulfates could be improved was to prepare the triethanolammonium salt rather than the sodium salt; see Tables 9 and 10 [129].

Normal alcohols ranging from  $C_{11}$  to  $C_{18}$  and five isomeric  $C_{13}$  aliphatic alcohols were sulfated or oxyethylated and then sulfated for a study of the effect of structure on surfactant properties [132]. The cotton-washing performance of the sodium sulfates of the n-primary alcohols (PA I) and a mixture of 75% n-primary and 25% 2-methyl alcohols (PA II) was determined; the results are shown in Table 13. The  $C_{11}$  and  $C_{12}$  members in both series of sulfated alcohols were much less effective detergents than their higher homologs. The  $C_{13}$  sulfates were intermediate and highest cotton-washing performance was attained at a chain length of  $C_{14}$  through  $C_{18}$ . There was a significant difference in performance between the PA I and the PA II series. The clear points for the above series of alcohol sulfates versus their carbon number are given in Table 14. The PA II sulfates (those containing 25% of the 2-alkyl isomers) were shown to be more soluble than PA I derivatives. The Kraft point for the n-primary alcohol sulfates increased linearly for the even-carbon-number compounds. The foam performance of the two series of primary alcohol sulfates in a heavy-duty high-foaming solid (HDHFS) detergent composition in which 10% of the active material was replaced by 10% of lauryl isopropanolamide (LIPA) was greatest at a carbon number of  $C_{15}$  for both series. While the peak in foaming occurred at  $C_{15}$ , there was a sharp rise between  $C_{13}$  and  $C_{14}$  and a sharp drop-off between  $C_{16}$  and  $C_{17}$ . The same two series of alcohols which were

TABLE 13  
Effect of Alcohol Carbon Number on Cotton Detergency of  
PA I<sup>a</sup> and PA II<sup>b</sup> Sulfates in Heavy Duty  
High Foaming Solid Detergents

Alcohol carbon number	Detergency rating of sulfates <sup>c</sup>	
	PA I	PA II
11	59	56
12	61	65
13	86	94
14	113	116
15	117	117
16	118	114
17	121	110
18	114	116

<sup>a</sup> n-Primary alcohols.

<sup>b</sup> 75% n-Primary alcohols + 25% 2-alkyl isomers.

<sup>c</sup> Terg-O-Tometer test, 150 ppm hardness, 0.04% active matter.  
LAS (C<sub>12</sub>, 6) = 100.

oxyethylated and sulfated to produce the primary alcohol-polyoxyethylene (3 moles) sulfates were studied. In this case, maximum foam performance was reached between C<sub>13</sub> and C<sub>14</sub>. A comparison of the two series shows that oxyethylation made the foam performance less dependent on chain length over the range C<sub>12</sub> to C<sub>15</sub>.

The amount of n-primary alcohol in blends of C<sub>12</sub>-C<sub>15</sub> alcohols with 2-alkyl isomers did not influence the cotton detergency of ethoxylates (82% ethylene oxide) or the foam performance of alkyl ethoxy sulfates; however, at least 65% of the n-primary alcohol was required for maximum detergency performance of the alkyl sulfates.

As can be seen from Table 15, a shift of the hydroxyl group from the end of the alkyl chain toward the center had a large deleterious effect on the performance of the alkyl sulfates. The shift of a methyl group exhibited a smaller effect. The effects noted are more pronounced for the C<sub>13</sub> alcohol than the C<sub>15</sub>. The placement of a -CH<sub>2</sub>OH group near the center of the chain (Gurbet alcohol) also has an unfavorable effect on performance [132].



TABLE 15  
Effect of Hydroxyl and Methyl Group Positions on the Performance and Properties  
of C<sub>13</sub> and C<sub>15</sub> Isomeric Alcohol Sulfates

Position	C <sub>13</sub>				C <sub>15</sub>			
	Surface tension dyn/cm at 50° C	Clear point <sup>a</sup> °C	Decrease Cotton detergency <sup>b</sup>	Foam performance <sup>c</sup>	Surface tension dyn/cm at 50° C	Clear point, °C	Decrease Cotton detergency	Foam performance
<u>Hydroxyl group</u>								
1	33.1	27	0	0	33.4	40	0	0
2	35.0	21	34	72	34.3	34	5	34
7	28.2	<0	51	88	24.5		33	98
<u>Methyl group</u>								
n-Primary alcohol	33.1	27	0	0	33.4	40	0	0
1 <sup>e</sup>	35.0	21	34	72	34.3	34	5	34
2	35.7	17	31	63	34.0	30	6	34
6	34.2	<0	29	77				

<sup>a</sup> 1% solution in distilled water, using alcohol sulfates that had been extracted with petroleum ether to remove unsulfated alcohol. The sulfates contain less than 0.45% inorganic salts (Na<sub>2</sub>SO<sub>4</sub>; traces of Na<sub>2</sub>CO<sub>3</sub>), based on alcohol sulfate.

<sup>b</sup> Percentage decrease in performance.

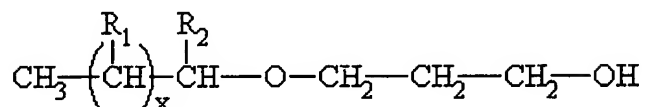
<sup>c</sup> Concentration, 0.040% alcohol sulfate (HDHS).

<sup>e</sup> Concentration, 0.025% alcohol sulfate (HDHS).

- . S. Nazarenko et al., Gazokondensaty Nefti, Mater. Srendezhat. auch. Soveshch, Neftskhim. Khim. Pererab. Uglevodородov, 2nd, 167, 361-364; Chem. Abstr., 71, 82933 (1969).
- Velea et al., Roman. Pat. 48,911 (1967), to Romania, Ministry of Chemical Industry; Chem. Abstr., 69, 20639 (1969).
- S. Sukhotarin and I. G. Agranovich, Mashlozhir Prom., 31, 39 (1965); Chem. Abstr., 65, 4113 (1967).
- J. Brooks and B. Brooks, U.S. Pat. 3,058,920 (1962), to The Zenith Corp.
- S. Nazrova and V. K. Tsyakovskii, U.S.S.R. Pat. 133,855 (1960); Chem. Abstr., 55, 10929 (1961).
- Nikel & Cie., G.M.B.H., Neth. Appl. 6,603,475 (1966); Chem. Abstr., 66, 37432 (1967).
- omania Ministry of Petroleum and Chemical Industry, Neth. App. 107,289 (1966); Br. Pat. 884,656 (1961); Chem. Abstr., 65, 4123 (1967).
- B. Kooyman, Neth. Pat. 81,602 (1956); Chem. Abstr., 51, 9183 (1957).
- H. van Heel, Neth. Pat. 84,711 (1957); Chem. Abstr., 52, 14650 (1958).
- Clippinger, Ind. Eng. Chem. Prod. Res. Develop., 3, 3 (1964).
- T. Kyll et al., Levest. Akad. Nauk Estom, S.S.R., Ser. Tekh. i mat. Nauk, 7 (2), 105-116 (1958); Chem. Abstr., 53, 5709 (1959).
- L. Kojinman and R. W. Kreps, Neth. Pat. 86,626 (1957); Chem. Abstr., 53, 14002 (1959).
- de Rafaele Petrola Maatschappij, Br. Pat. 782,466 (1957).
- V. Mlodovidova et al., Tr. Vses. Nauchn.-Issled. Inst. po Parer-ke Nefti, 2, 81 (1963); Chem. Abstr., 60, 1938 (1964).
- International Research Maatschappij N.V., Br. Pat. 465,435 (1964).
- Berber and R. V. Raffuse, U.S. Bur. Mines, Rep. Invest. 1968, 7115.
- Julia, Br. Pat. 655,459 (1951), to Neamloose Vennootschap de afsche Petrola Maatschappij.
- Garnier and H. N. Short, Br. Pat. 656,084 (1951), to Shell Re-g and Marketing Co., Ltd.
- At Anon. des Produits Chimiques Shell-Saint Gobain, Fr. Pat. 5,165 (1960).
- ill and J. Vyskoell, Abhandl. Deut. Akad. Wiss. Berlin, Kl. a. Geol. Biol., 1963 (2), 13-25; Chem. Abstr., 60, 10530 (1964).
- zmidgal and H. Pasternak, Fette, Seifen, Anstrichmittel, 66, 225 (1963).
- Rutledge, Ger. Pat. 1,403,963 (1969), to Atlas Chemical Indus-trienig, P. Hahn, K. Sticksdon, and H. G. Braun, Ger. Pat. 1,118 (1968), to Veb Deutsches Hydrierwerk Rodleben.
113. J. K. Weil, A. J. Stirton, and E. B. Leardi, J. Am. Oil Chemists' Soc., 44, 522 (1967).
114. J. E. Gotte, Fette Seifen Anstrichmittel, 56, 583 (1954).
115. A. Lothermoser and F. Stoll, Kolloid Z., 63, 19 (1933).
116. J. N. Bone and D. W. O'Day, J. Am. Pharm. Assoc., 47, 795 (1958).
117. E. W. Maurer and A. J. Stirton, U.S. Pat. 3,305,578 (1967), to United States of America.
118. E. W. Maurer, A. J. Stirton, and J. K. Weil, J. Am. Oil Chemists' Soc., 37, 34 (1960).
119. E. W. Maurer and A. J. Stirton, U.S. Pat. 3,133,946 (1964), to United States of America.
120. E. W. Maurer and A. J. Stirton, U.S. Pat. 3,291,750 (1966), to United States of America.
121. R. G. Bistline, Jr., A. J. Stirton, and E. W. Maurer, J. Am. Oil Chemists' Soc., 34, 516 (1957).
122. G. Braude, R. R. Egan, M. Warren, and L. Galitzin, Chem. Spec-ialties Mfrs. Assoc. Proc. Ann. Meeting, 43, 174-178 (1956).
123. J. K. Weil, A. J. Stirton, and E. A. Barr, J. Am. Oil Chemists' Soc., 43, 157 (1966).
124. F. J. Gohlke and H. Berghansen, Soap Chem. Specialties, 43, 60 (1968).
125. S. P. Harrold, J. Colloid Sci., 15, 280 (1960).
126. J. K. Weil, A. J. Stirton, and R. G. Bistline, Jr., J. Am. Oil Chem-ists' Soc., 31, 444 (1955).
127. J. K. Weil, A. J. Stirton, and E. W. Maurer, J. Am. Oil Chemists' Soc., 32, 148 (1955).
128. A. J. Stirton, E. W. Maurer, and J. K. Weil, J. Am. Oil Chemists' Soc., 33, 290 (1956).
129. J. K. Weil, A. J. Stirton, and R. G. Bistline, Jr., J. Am. Oil Chem-ists' Soc., 36, 241 (1959).
130. J. C. Cowan, J. K. Weil, and A. J. Stirton, U.S. Pat. 2,938,872 (1960), to United States of America.
131. S. H. Leiber, Am. Dyestuff Repts., 22, 663 (1933).
132. B. M. Finger, G. A. Gillies, G. M. Hartwig, W. W. Ryder, Jr., and W. M. Sawyer, J. Am. Oil Chemists' Soc., 44, 525-530 (1967).
133. V. V. R. Subrahmanyam and K. T. Achaya, J. Chem. Eng. Data, 6, 38 (1961).
134. K. Shimokai and M. Fukushima, Yuhagaku, 12, 516 (1963); Chem. Abstr., 60, 7032 (1964).
135. F. Fischel, Tenside, 3, 71 (1966).
136. M. Kashiwagi and H. Ezaki, Bull. Chem. Soc. Japan, 32, 624 (1959); Chem. Abstr., 54, 8115 (1960).
137. J. Pearson and A. Lawrence, Trans. Faraday Soc., 63, 468 (1967).
138. T. P. Matson, Soap Chem. Specialties, 34, 52 (1963).
139. M. Matsuda, N. Kawamura, W. Yano, and W. Kimura, Yuhagaku, 16, 132 (1969).

## AMENDMENTS TO CLAIMS

1. (Original) A branched alcohol composition comprising  
a branched ether primary alcohol represented by the formula:



wherein R<sub>1</sub> represents hydrogen or a hydrocarbyl radical having from 1 to 3 carbon atoms, R<sub>2</sub> represents a hydrocarbyl radical having from 1 to 7 carbon atoms, x is a number ranging from 0 to 16, wherein the total number of carbon atoms in the alcohol ranges from 9 to 24.

2. (Original) The branched alcohol composition of claim 1 wherein R<sub>2</sub> is a hydrocarbyl radical having 1 carbon atom.
3. (Original) The branched alcohol composition of claim 2 wherein R<sub>1</sub> is hydrogen.
4. (Original) The branched alcohol composition of claim 1 wherein x is a number ranging from 3 to 13.

Claims 5-49 (Canceled)

50. (Withdrawn) A process to produce a the branched alcohol composition of claim 1, the process comprising:

contacting an olefin having an average carbon number in the range of 3 to 18 with 1,3-propane diol in the presence of a catalyst effective to react the olefin with the diol under conditions effective to produce the branched alcohol composition of claim 1.

51. (Withdrawn) The process of claim 50 wherein the catalyst is an acid catalyst.
52. (Withdrawn) The process of claim 51 wherein the average carbon number of the olefin is in the range of 6 to 18.
53. (Withdrawn) The process of claim 51 wherein the diol and olefin is contacted at a temperature within the range of from 50 °C to 250°C.

Claim 54 (Canceled)

55. (New) The branched alcohol composition of claim 1 wherein the total number of carbon atoms in the alcohol ranges from 9 to 20.

56. (New) The branched alcohol composition of claim 1 wherein the branched ether primary alcohol comprises 3-dodecyloxy-1-propanol.

57. (New) The branched alcohol composition of claim 56 wherein the 3-dodecyloxy-1-propanol comprises a hydroxypropyl group attached at the 2-carbon position of a dodecyl moiety.

58. (New) The branched alcohol composition of claim 56 wherein the 3-dodecyloxy-1-propanol comprises a hydroxypropyl group attached at the 3-carbon position of a dodecyl moiety.

59. (New) The branched alcohol composition of claim 1 wherein the branched ether primary alcohol comprises 3-hexadecyloxy-1-propanol.

60. (New) The process of claim 50 wherein the olefin has an average chain length of 12 to 16 aliphatic carbons.

61. (New) The process of claim 53 wherein the diol and olefin are contacted at a temperature within the range of from 100 °C to 200°C.

62. (New) The process of claim 50 wherein the olefin comprises an alpha olefin.

63. (New) The process of claim 50 wherein the olefin comprises a linear alpha mono-olefin.

64. (New) The process of claim 50 wherein the olefin comprises an internal olefin.

65. (New) The process of claim 50 wherein the olefin comprises 1-dodecene.

66. (New) The process of claim 50 wherein the olefin comprises 1-tetradecene.

67. (New) The process of claim 50 wherein the olefin comprises 1-hexadecene.

68. (New) The process of claim 50 wherein the olefin comprises C15/C16 internal olefins.

- 69. (New) The process of claim 50 wherein the olefin is obtained from ethylene oligomerization.
- 70. (New) The process of claim 50 wherein the olefin is obtained from Fischer-Tropsch synthesis.
- 71. (New) The process of claim 51 wherein the catalyst comprises a homogeneous catalyst.
- 72. (New) The process of claim 51 wherein the catalyst comprises a heterogeneous catalyst.
- 73. (New) The process of claim 51 wherein the catalyst comprises an organic sulfonic acid.
- 74. (New) The process of claim 51 wherein the catalyst comprises toluenesulfonic acid.
- 75. (New) The process of claim 51 wherein the catalyst comprises p-toluene sulfonic acid.
- 76. (New) The process of claim 51 wherein the catalyst comprises trifluoromethane sulfonic acid.
- 77. (New) The process of claim 51 wherein the catalyst comprises a zeolite.
- 78. (New) The process of claim 50 wherein the catalyst comprises a molecular sieve.